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PATENT

## HEAT-RESISTANT ALUMINUM-SILICON PISTON ALLOY

### BACKGROUND

[0001] The invention relates to an alloy in accordance with the features of the preamble of claim 1.

[0002] Alloys which consist of quantities of aluminum and silicon are basically well known. At least one additional alloying element is added to such aluminum-silicon alloys, depending on the particular application, to increase the strength of the alloy. Minute amounts of contaminants cannot be avoided in the practical manufacture of such alloys so that known alloys consist of a specific percentage of aluminum, a specific percentage of silicon and a specific percentage of at least one or more alloying element, and another percentage (much smaller than 1%) of contaminants are included in the total.

[0003] It would be desirable to improve a heat-resistant aluminum-silicon alloy with respect to its strength, or rather its load capacity, and to give appropriate applications.

### SUMMARY

[0004] It is proposed that the amount of at least one additional alloying element in an aluminum-silicon alloy is selected such that a microstructure with a plurality of intermetallic phases is built up. In a particularly advantageous way, the result is an increase in the strength of the alloy, and with it, the increase in the strength, or rather, the increase in the load capacity, of a component consisting of the alloy.

### BRIEF DESCRIPTION OF THE DRAWING

[0005] The various features, advantages and other uses of the present invention will become more apparent by referring to the following detailed description and drawing in which Figs. 1 and 2 are, respectively, sections through an edge of a combustion dish and a piston wrist pinhole area.

## DETAILED DESCRIPTION

**[0006]** In the case of an aluminum-silicon alloy, the content of an additional alloying element, or in the total amount of at least additional alloying elements which are not silicon, is set so high that the surface percentage of intermetallic phases with silicon amounts below 30% is 1.15 times as high or higher on the average in a polished surface through a section of the material of the alloy than the surface amount of silicon-rich particles with silicon contents above 90%. In a further aspect, strength and load capacity are increased because in a polished surface through a section of this alloy the surface percentage of intermetallic phases with amounts of silicon below 30% is 1.3 times as large or larger on the average than the surface amount of silicon-rich particles with silicon contents above 90%. Increasing strength and load capacity even more is the fact that in a polished surface through a section of this alloy, the surface percentage of intermetallic phases with silicon amounts below 30% is 1.5 times as great or greater on the average than the surface percentage of silicon-rich particles with silicon contents above 90%.

**[0007]** It is furthermore possible that the percentage by mass of one alloying element, or additional alloying elements which are not silicon, amounts to at least 75% of the percentage by mass of silicon. This results in a further increase in intermetallic phases which contribute to strength and load capacity.

**[0008]** In another aspect, the at least one alloying element is copper, where the copper content makes up at least 5% or more of the total weight of the alloy. An economical and simple to handle material is available in copper which, if it is a component part of the alloy, contributes effectively to increasing the intermetallic phases. In addition to copper, comparable materials which achieve the same effect can be used.

**[0009]** In one way, the previously described alloy finds a use in a component for a combustion engine, where this may be static components (such as the crankcase, for example) or moving parts (such as pistons, piston wrist pins, connecting rods, crankshafts and similar). In one way, the alloy from the invention finds a use in a piston and, specifically, in an upper part of the piston. Since the upper part of the piston (also called the piston crown) faces in the direction where combustion takes place inside the cylinder of the combustion engine, there is an unusual load there as a result of ignition

pressures and combustion temperatures required to comply with mandated emissions specifications. This load can be counteracted in one way with the alloy described above so that, as a result, a highly load-tolerant and adequately strong piston is available. The alloy can be used in one-piece or multi-piece pistons, where, depending on the construction of the piston, the entire piston or only a part of the piston is made from the heat-resistant alloy. Here, for example, it must be mentioned that a piston for an Otto-cycle combustion engine, in particular, a piston for a diesel combustion engine, has a combustion dish in the piston, and the edge of the dish at least partially, but, in particular, completely around the radial circumference, consists of the heat-resistant alloy from the invention. This heat-resistant alloy has in addition the advantage that the areas which consist of this alloy form a tight bond with areas of the piston which consist of another material (for example, lightweight material such as aluminum).